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THE DEVELOPMENT AND EMERGENCE OF THE AMERICAN DE HAVILLAND (DH-4) AEROPLANE: WHY THE DH-4 AND HOW DID IT FARE IN WORLD WAR I?

A Research Paper

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by

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The views expressed in this academic research paper are those of the author(s) and do not reflect the official policy or position of the US government or the Department of Defense.

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Preface

When the United States entered World War I on 6 April 1917, the American Air Service was comprised of an inept Aviation Section of the Signal Corps. The two airfields operated by the United States Army at the time was comprised of only 55 trainers. Not a single unit had been trained for, much less participated in, aerial warfare.

The main issue addressed in this report is why the United States opted to produce the De Havilland 4 (DH-4) aircraft, how it compared to other aircraft operating on the battle front, and it's impact on the future of American aerial combat. Additionally, I will discuss the major shortfalls and advantages of the aircraft as explained by the young aerial warriors who fought from the bitter cold cockpits of the DH-4 high over the Somme, St. Mihiel, the Meuse-Argonne, and other areas. My main purpose is therefore to give the reader a solid picture of the buildup of the American air arm during WWI, the capabilities and limitations of it's primary aircraft (the DH-4), and it's impact on the future of American airpower.

I would like to acknowledge my research advisor, Dr. Michael Grumelli, for his enthusiasm, guidance, knowledge, and assistance in the accomplishment of this research project.

Abstract

This report contains a detailed account of the reason(s) why the United States elected to mass produce the De Havilland 4 (DH-4) aircraft as the primary American bomber and reconnaissance platform for use in World War I. Additionally, the DH-4 is compared and contrasted with other preeminent German and Allied aircraft of the era. This report also contains the views and comments of America's first combat pilots on the capabilities and limitations of the DH-4.

The primary methodology utilized in conducting this research included the investigation of primary sources such as the 1917-1918 editions of the New York and London Times, and documented oral histories of the young United States Air Service officers that flew the DH-4 during WWI. Additionally, many secondary sources were investigated in order to establish the performance of the DH-4 and it's impact on future of aerial combat. Lastly, many elective seminar sessions were conducted by the research advisor with the purpose of establishing the essence of America's first air war.

Chapter 1

Predominant Allied and German Aircraft as of 6 April 1917

By May 1899, most of Europe was caught up in an extensive arms race brought on by a new dimension in warfare—aerial warfare conducted by balloons. Although the first Hague convention sought to promote a "general peace and a possible reduction of excessive armaments," every major army in Europe had for some time been making an ongoing investment in military aeronautics.[1] The second Hague convention, assembled in 1907, established an extension on the ban of "militarizing" the skies. However, by 1914, Great Britain was the only nation to ratify the ban. Between 1907 and 1914, most major European countries were putting forth great effort in merging the military with aeronautics and the development of aerial armament.

In the three years preceding World War I, the predominant countries in the field of military aeronautics were France, Italy, Germany, and Great Britain. Their interest in the airplane was spawned by Orville Wright who, by accomplishing aerial demonstrations and public appearances, made a profound impression in Europe on the potential of the airplane. Most countries viewed the airplane as a military necessity, thus, for the first time in history, the race was on for the most advanced, capable, and dependable military aircraft.

When World War I broke out in Europe in the summer of 1914, the airplane was viewed primarily as an aerial scout. It was used mainly to augment the balloon forces in the reconnaissance role. The airplane was able to observe "over the horizon" enemy activity, well past the capability of the observation balloon. In the early months of the war, all pilots adhered to a code of chivalry that forbade the harming of another aircraft and fellow flyer. Soon, however, enemy pilots began shooting at each other, and the aircraft quickly became an instrument of destruction.

Roland Garros, a Frenchman, mounted a fixed machine gun on his Morane-Saulnier to fire through the propeller arc, and fitted steel plates on the propeller shanks to deflect the bullets (about seven percent of the total fire) which hit it. Anthony Fokker, then working for the Kaiser in Germany, improved on this by inventing the interrupter gear that prevented the gun from firing when the propeller blades were passing the bullet path. Next, a Rumanian-born engineer living in England, Constantinescu, topped Fokkers mechanism with the design of the hydraulically operated gun-synchronizing gear, which reversed the process by firing the gun at the moment when the propeller blades were not passing in front of the barrel. Once pilots started shooting at each other, the question of plane performance leaped to the number one position.[2]

There were numerous aircraft and aircraft versions that saw action during World War I, but there were only a few predominant Allied and German aircraft on the battlefront just prior to and during America's involvement in the war. One of the most outstanding fighters (pursuit) on either side was the Spad. This maneuverable, fast, and dependable French built machine was powered by numerous engines, but the favored engine was the Italian built 220 horsepower Hispano-Suiza type. This aircraft (SPAD XIII), later to be

purchased and flown by the United States and Great Britain, stacked up nicely with it's main German pursuit foe, the Fokker DVII. Although the Fokker DVII, outfitted with the 185 horsepower BMW engine, was not as fast at altitude as the SPAD XIII, it was more maneuverable and just as deadly. The most effective of the British pursuit types was the S.E.5, produced by the Royal Aircraft Factory. Like the SPAD, the S.E.5 was powered by the Hispano-Suiza engine. Unlike the SPAD, however, the S.E.5 mounted three guns instead of two. Two of the fixed guns were mounted to fire through the propeller, while a third was fixed to fire over the top wing. This configuration increased dependability when engaged in aerial combat and minimized the effects of one gun becoming jammed.

Figure 1. Spad XIII

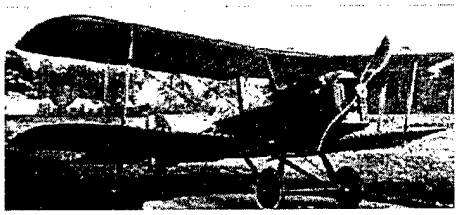

Figure 2. British SE-51

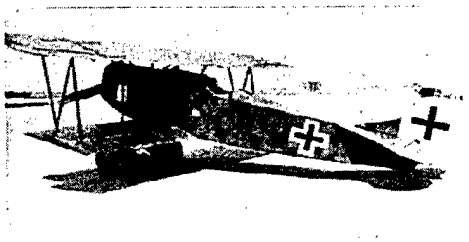

Figure 3. German Fokker D-VII

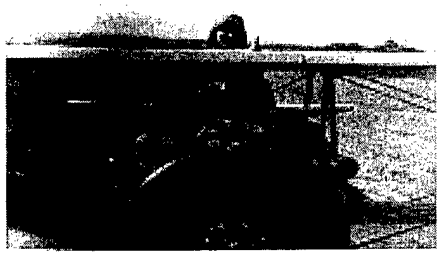

Figure 4. Rickenbacker in Spad XIII

At the start of the war, even though aerial bombing (hand grenades) preceded air-to-air fighting, neither the Germans, French, or British were serious about utilizing aircraft as medium or heavy bombers. Soon the plausibility and advantages of aerial bombardment were realized, and large powerful aircraft with large bomb capacities were produced. The Germans built the Gotha, which was powered with two 260 horsepower engines and capable of carrying 1000 pounds of bombs. The Gotha was used by the Germans for the more serious bombing raids on the city of London. The top Allied heavy bomber of World War I, often referred to as the "B-29" of WWI, was the British built Handley Page bomber. The Handley Page was powered by two 275 horsepower Rolls-Royce engines and had a bomb capacity of 1100 pounds.

Although the French recognized the need for the development of bombers, they also saw the need for an aircraft which was multi role capable. This aircraft should have the ability to carry an effective ordnance load for bombing missions, and be capable of performing the observation and aerial engagement missions. The medium bomber developed by the French was the Breguet 14B-2. This aircraft, 378 of which were flown by the United States Air Service, was powered by a 300 horsepower Renault engine and carried a single Vickers gun which fired through the propeller. The observer handled two Lewis guns on a scarf ring, and 520 pounds of bombs mounted on wing racks. The

French Breguet 14B-2 was viewed by engineers and aviators alike as the best all around medium size bomber and reconnaissance platform of the war.

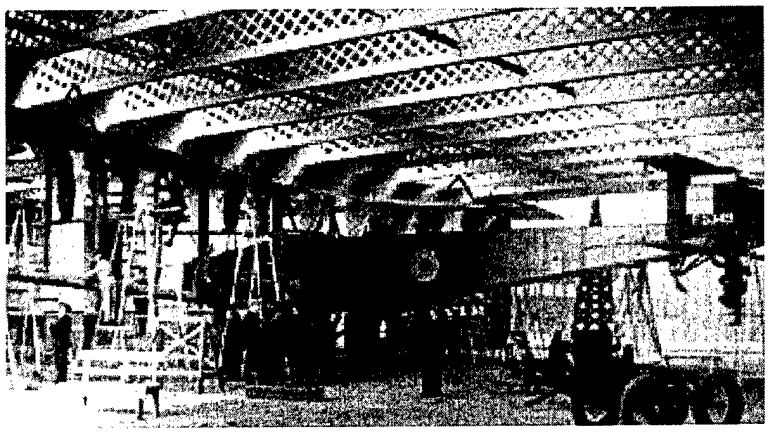

Figure 5. British Handley-Page Heavy Bomber

Figure 6. French Brugeut Medium Bomber

Notes

[1] Lee Kennett, *The First Air War 1914*-1918, (New York: The Free Press, Macmillan inc., 1991), 2.

[2] Douglas Rolfe, *Airplanes of the World*, (New York: Simon and Schuster, 1954), 32.

Chapter 2

The Bolling Commission: Mission, Findings, and Recommendations

When the United States entered "the war to end all wars" on 6 April 1917, there was not a single air unit that had trained for aerial warfare and no American then serving in the American military with actual combat flying experience. There were only two flying fields operated by the United States Army which, combined, had only 55 trainers of which General John J. Pershing later said "51 were obsolete and the other 4 were obsolescent." This amazing lack of preparedness in America's air arm is difficult to acknowledge especially when the air war in Europe had raged for three years and the possibility of US intervention became greater. This lack of preparedness can be primarily contributed to the failure of congress to appropriate money for military aeronautics and the lack of plans and programs on the military's part to build a tangible air strength that could fight in Europe. Another factor that impacted America's readiness, through the eyes of the people and the government, was that the war was a European fight and posed no threat to the US or to its national interests abroad.

Congress, the military, and the American people received a boost from France and Britain in July 1917. Both countries sent well staffed missions to Washington to appeal for full participation of the United States on the battle front. There is considerable

evidence that Lt. Col. William "Billy" Mitchell, then in France as an air officer, contrived to have the French government (French Premier Alexander F. Ribot) put pressure on the United States to increase it's air Program.[1] As a result, congress appropriated $640 million (Administration Aviation Bill) without a roll call for the production of 22,625 aircraft.[2] Since the outbreak of hostilities in 1914, Great Britain, France, Italy, and Germany had outstripped the United States in aeronautics. It was now time for America to attempt to close the technological gap and rapidly catch up in terms of both quantity and quality of aircraft.

There were several combined joint aeronautical committees formed from the start of hostilities, but perhaps the most important of these was the Aircraft Production Board, a subsidiary of the Council of National Defense. Although Congress appropriated adequate funding for the Air Service, it was soon realized that money alone would not build an effective fighting force. As a result, the Aircraft Production Board established the Bolling Commission, headed by Major Raynal C. Bolling, which was armed with broad authority from the secretary of war to study aircraft design and production facilities in France, England, and Italy. Although only recently commissioned in the Army, Major Bolling was an excellent choice to head the European mission. In addition to having served as general council to the United States Steel Corporation, he had long been prominent in aviation circles. He had taken an active and significant part in establishing the Aero Club of America, and also induced several affluent New Yorkers to establish, organize, and promote the Air Reserve for New York.

The Bolling Commission, comprised of both military and civilian engineers and technicians, left for Europe on 17 June 1917 to gather information for the production of

airplanes, engines, and other aeronautical equipment. It's principle objectives were: (1) to establish free exchange of rights to manufacture all classes of aviation material; (2) to send sample airplanes, engines, and accessories to the United States; (3) to prepare for the purchase of aircraft in Europe; (4) to prepare for the training of personnel in Europe; and (5) to assist the Air Service of the Allies by allocation of raw materials.[3]

The Bolling Commission was under strenuous pressure to accomplish their mission as quickly as possible in order get to the battle front and fill the German skies with American aircraft and aviators. This expedient mission is summarized in Major Bolling's report to Washington on 15 August 1917:

> The Aeronautical Commission under my charge left New York on the steamship "Adriatic" June 17, 1917, landed at Liverpool June 26, 1917, proceeded to London, remained there about a week, proceeded to France and to Paris, remained there about two weeks, proceeded thence to Italy, remained there about ten days, returned to Paris and remained there about ten days. Thereafter the party was divided according to new instructions and duties.[4]

Figure 7. Major Raynal C. Bolling

Even though the tour was accomplished in a very expedient fashion, the Bolling Commission was able to gather valuable information and collect combat airplanes and other aviation items and send them to the United States for testing and possible reproduction. The British aircraft delivered to the United States on 18 July 1917 included

the S.E.5 fighter, the Sopwith "Camel" fighter, and the dual purpose De Havilland 4 (DH-4) observation-bomber aircraft. Because the United States was entering a conflict that was mature in nature, and that the war was a struggle of infantry, trenches, and artillery, the Bolling Commission realized that the United States Air Service would be forced into the pattern of battle already established. As a result of these findings, and the lack of time to develop purely American designs, the Bolling Commission initially recommended that the United States build French Spad VII fighters, British Bristol pursuits, and the British De Havilland 4 observation-bomber. Later, the Commission recommended that the pursuit production be left to the allies, and that the United States concentrate it's prime efforts in the production of the British De Havilland DH-4. This recommendation was a result of the nature of trench warfare and the need for more than just sporadic bombing. Major Bolling sums up the need for massive bomber production in his 15 August 1917 report of the Aeronautical Commission:

> Could bombing be conducted on a sufficiently great scale and kept up continuously for a sufficient time, there seems good reason to believe that it might determine the whole outcome of military operations. Up to the present time, the trouble seems to have been that all bombing has been carried on intermittently and sporadically because of the lack of attention to the subject and provision for large enough numbers of the right kind of airplanes. In this connection, it may be well to compare the situation with artillery bombardment. While I speak with some diffidence on the subject, all I have been able to learn indicates that intermittent and sporadic artillery bombardment produces but small results notwithstanding the great size and accuracy of modern bombardment artillery. When definite and important results are desired, artillery bombardment must be made systematic and continuous and tremendous quantities of high explosives must be used on the selected objectives. This seems to be exactly the situation which exists with respect to airplane bombardment.[5]

There is another reason why the Bolling commission advised for the production of two seat bomber-reconnaissance type aircraft instead of the production of single seat

fighter (pursuit) aircraft. The numbers, types, and technological advances of pursuit aircraft was so rapid that few pursuit aircraft retained their superiority for more than six months. As a result, the pursuit aircraft was one of the most short-lived of all the implements of World War I. For example, since the beginning of the war, the French put thirty-one types of single-seater aircraft into service, the British twenty-seven, the Italians thirteen, and the Germans twelve (six new types after the United States entered the war).[6] Therefore, the Bolling Commission reasoned that if single seat pursuit machines were built in the United States, they would be obsolete by the time they arrived at the battle front with sufficient numbers.

Having recommended the De Havilland DH-4 for production in the United States, the Bolling Commission also recommended that some design changes would be necessary with the intent of increasing the bomb load capacity. On 2 August 1917, Bolling cabled that the British have already made the required modifications and now call it the De Havilland 9 (DH-9). Armed with this information the United States prepared for the mass production of the British DH-9, with one exception, the DH-9's 230 horsepower Siddeley Puma engine would be replaced with the 400 horsepower American built Liberty engine. However, by the fall of 1917 it was decided that the design of the DH-9 was not yet sufficiently settled, and by February 1918 the contracts for the production of 3000 DH-9's were replaced with the same number of DH-4's (with the Liberty engine).[7]

While the Bolling Commission was engaged in it's mission, General, then Colonel, Billy Mitchell was in France consulting with the French Aeronautic Headquarters on the prospective of American aviation. Mitchell, realizing that the French were making two-thirds of the airplanes used by the Allies, and that their aircraft were practical, efficient,

and attainable, recommended to Washington that the United States adopt the Spad pursuit and Bregeut medium bomber types and begin production immediately in French factories. He saw the practicality of utilizing existing overseas factories, augmented by American mechanics and raw materials, for the production of aircraft to by flown by the United States Air Service. The greatest threat to the United States in Mitchell's eyes was that of time, and the greatest value of our assistance to Allies would be immeasurably increased by producing quality, battle tested aircraft as quickly as possible instead of waiting to organize US industrial strength.

Washington, and the Aircraft Production Board, paid little or no attention to the suggestions made by Colonel Mitchell. The findings and recommendations of the Bolling Commission was to take precedence over the person on the ground, the one intimately familiar with the conditions and aircraft of Europe. Mitchell's frustrations about this subject are summed up in his memoirs of World War I:

> No attention was paid by Washington to these suggestions from me....It was the beginning of a series of blunders made by those directing aviation in Washington, which culminated later in that department being virtually removed from the authority of the War Department and put into the hands of businessmen. The feeling was prevalent in the United States, helped on by British propaganda, that the English, possessing as they did the powerful bond of common language and common decent, understood us better than the French did. Therefore, our instinct was to favor British equipment and British methods of doing things. This led to a foolish and disastrous move on the part of those in charge of aviation, that is, taking an English airplane for production, which had been made for an English engine, and attempting to put into it an entirely new American engine which had never even been tried out, much less designed in connection with this particular airplane. I refer to the De Havilland airplane and the Liberty engine. As it was, this one decision held up the delivery of American equipment to the air forces for an entire year, and constituted one of the most serious blunders that has ever occurred in our military service.[8]

Figure 8. Colonel William Mitchell (center).

Notes

[1]James J. Hudson, *Hostile Skies*, (New York: Syracuse University Press, 1968), 5.

[2]New York Times, "America to Produce 3500 Planes a Month" 6 July 1917, 6.

[3]James J. Hudson, *Hostile Skies*, (New York: Syracuse University Press, 1968), 13.

[4]Mauer Mauer, *The US Air Service In World War I*, Vol. II, (Washington D.C.: Air Force Office of History, 1978), 131.

[5]Ibid., 132.

[6]James J. Hudson, *Hostile Skies*, (New York: Syracuse University Press, 1968), 14.

[7]J. M. Bruce, *De Havilland Aircraft of World War One*, (London: Arms and Armour, 1991), 40.

[8]Brigadier General William Mitchell, *Memoirs of World War* I, (New York: Random House, Copyright 1960), 17.

Chapter 3

The Emergence of the American Built De Havilland 4

On 14 August 1917, only two month's after the Bolling Commission left for Europe, the Dayton-Wright company was selected to manufacture the DH-4. Using the British aircraft received in July as a sample, the first American built DH-4 was virtually accomplished by hand. The aircraft from England was torn down, photographed, and analyzed, with drawings made every step of the way. In all, drawings for 35,330 different components, including 2,608 wood parts, 1,665 sheet metal parts, 20 forgings, 366 pieces of fabric, and 474 pieces of equipment were scrutinized and corrected. Three talented people accompanied the sample DH-4 from England. George Hanckock was shop superintendent for Airco, while Mr. H. Chapman was an expert on maintenance; his wife was a W.A.A.C., and an expert in quality control of DH-4's. All three were significant contributors to the successful adaptation of the DH-4.[1]

Realizing there was to be many production changes, the people at Dayton-Wright did not standardize production of the remaining aircraft on the outcome of the first DH-4. This was primarily due to the difference in the English and American manufacturing philosophies. In their tradition of craftsmanship, the English worked with a system of "fits" to match their parts together which was demanding of the workers. The Americans worked with a system of "tolerances" which was much less demanding of the worker on

the floor, but much more demanding of the original drawings, jigs, and tools. As a result, Dayton-Wright designated the number thirty airplane as the standard for production. The first American built DH-4 flew on 29 October 1917, a little over 90 days from the delivery of the English version. The following quotation is an account of that hair-raising first flight:

> Howard Rinehart, a large, likable man who contributed much to aviation and to Dayton-Wright, reportedly took the plane up on it's initial flight and proceeded to wring it out with rolls loops and other maneuvers. A Dayton-Wright employee, Archie Freedman, rode in the gunners compartment. During inverted flight, the wood screws holding his seat stripped and Freedman almost fell out. An extremely entertaining reminiscence about the first flight of an important aircraft.[2]

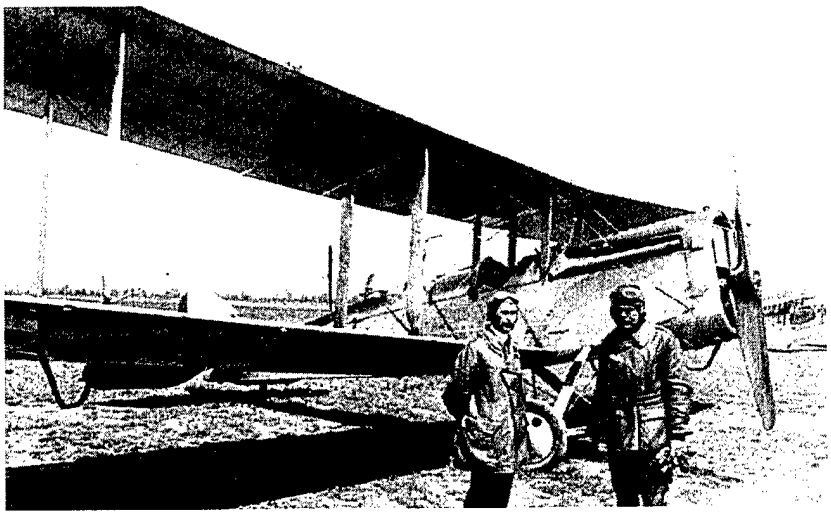

Figure 9. Reinhart (right) in front of DH-4 with Orville Wright

The United States Air Service and Dayton-Wright had a strong desire to get a DH-4 en route to France prior to 1 January 1918. However, the initial burst of speed in production was offset by several months of delays by a series of changes, primarily in armament. The foreword armament of two Marlin machine guns was specified by the US Army, which in itself was not a problem, but which caused difficulties with cartridge

ejection and synchronizing gear. This, along with many minor changes, took time to agree upon, create drawings, and then manufacture the parts.

The evolution of the 400 horsepower Liberty engine that would eventually power the Dayton-Wright DH-4 aircraft dates back to mid May 1917. By this time, the Aircraft Production Board had already decided that the United States would not follow the European example in the development of aircraft engines. France and Great Britain simply had too many versions of aircraft engines (France with 46 and England with 37). This great disparity in engine design would create many problems in the United States with respect to mass production, spare parts, and so on. It was determined by Colonel Edwin Deeds and S.D. Waldon, both members of the Aircraft Production Board, that the best way for United States to bring it's industrial strength to bear was to build a small series of engines with substantially the same components. These engines could be fitted with additional cylinders to increase the horsepower.[3]

About this same time, Elbert J. Hall and Jesse G. Vincent, both successful engineers in U. S. heavy industry, were in Washington to sell their particular engines (developed by private industry). Having met with Deeds and Waldon, the two men got together and virtually locked themselves inside the Willard Hotel and systematically exchanged ideas and integrated brainpower to lay out a proposed design. By the end of May, Vincent and Hall were awarded approval of their engine design and departed for the Packard company in Detroit to supervise the construction of the engine. Less than three months later, on 25 August, the first 400 horsepower 12 cylinder Liberty engine passed a 50 hour test (which the British believed to be impossible), and on 29 October 1917, the first American Built

DH-4 was flown with the number 4 production Liberty engine. The wonderful American combination of greed and patriotism had come together to make the Liberty engine.[4]

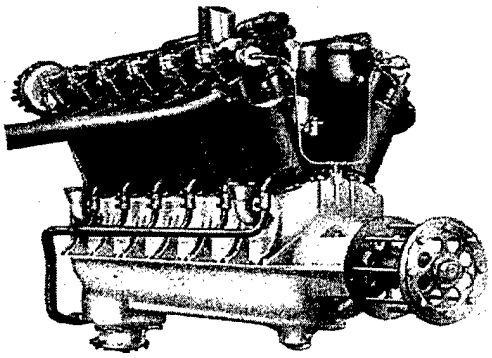

Figure 10. 400 HP Liberty Engine

Although the production processes of the Liberty engine and the DH-4 were entirely separate, the coordination between Dayton-Wright and the US automobile industry that built the Liberty (Packard, Lincoln, Ford, etc.) allowed for a smooth mating schedule of aircraft and engine. By the end of production, 20,478 Liberty engines had been built and would dominate the field for the next ten years.

During the early month's of 1918, the production of the DH-4 gathered steam and the United States began a tremendous buildup in fighting strength. The DH-4 aircraft and the Liberty engines would be packed in shipping crates and sent to France for assembly. The main assembly plant for the DH-4 was the Air Service Production Center No. 2 at Romorantin. This air depot grew from a pine forest in early January 1918 to a massive industrial complex with more than 2,800,000 square feet of building area when the war ended. Of the 12,000 officers and soldiers employed at Romorantin, more than 1,100 were dedicated to DH-4 assembly. The first group of DH-4's arrived in France on 6 May 1918 and were sent to the Air Service Production Center for assembly. In addition to

assembling aircraft, Romorantin also served as the main spare parts depot for the DH-4 and the Liberty engine.[5]

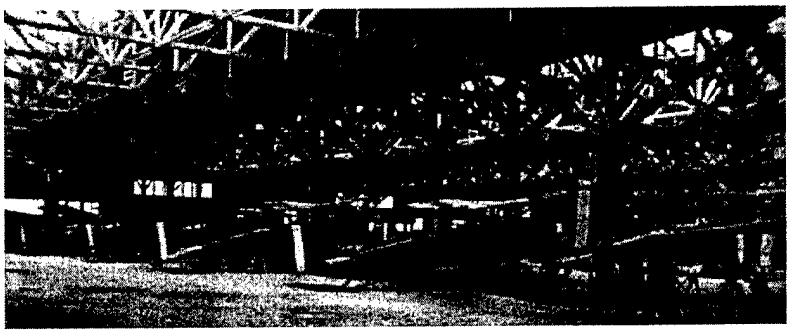

Figure 11. Production Center at Romarantin

Among the first to receive the new Liberty planes was the 135th Aero Squadron at Ourches, and in early August 1918, the first mission was flown "by American pilots, in American airplanes, powered by American engines.

> Eighteen Liberty planes were lined up, nose to tail, with Brigadier General Benjamin D. Foulois, Chief of the Air Service, in the lead plane, piloted by 1st Lt. A. Blair Thaw. With cameras rolling the formation trundled off single-file from the field into murky weather that caused the unit soon to break up, with no airplane penetrating further than Nancy, a considerable distance behind the front lines. The lack of concrete results did not matter, for the morale effect was tremendous.[6]

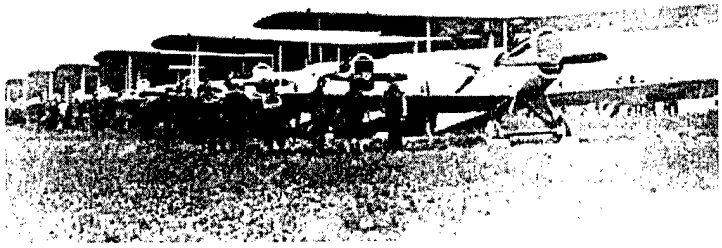

Figure 12. Just Prior to Launch; Liberty's First Mission.

A measure of America's production effort of the Liberty plane was provided by Colonel Edgar S. Gorrell in his 1940 lecture entitled "The Measure of America's World

War Aeronautical Effort" delivered at Norwich University. In this lecture, he provided a detailed account of the statistics relating to the American built DH-4 up to the end of the war. The total delivered to the US government by 11 November 1918 was 3,431 (more than three times the British production), total received overseas was 1,213, 499 were sent to squadrons, and 417 were actively used by squadrons at the battle front.

Notes

[1]Walter J. Boyne, *De Havilland DH-4: From Flaming Coffin to Living Legend,* (Washington D.C.: Smithsonian Institution Press, 1984), 37.
[2]Ibid.
[3]Ibid., 38.
[4]Ibid.
[5]Ibid., 48.
[6]Ibid., 50.

Chapter 4

The DH-4 Over the Battle Front

If one looks at the origin of the DH-4 design, it should be noted that the aircraft was established with mid-1916 technology. This United States Air Service entered a mature war with, essentially, an outdated aircraft design. The first deliveries in quantity of these machines in Europe were not made until June and July, 1918, and by that time the supremacy of the DH-4 had been partially lost. However, with any piece of military equipment, its efficiency can only be increased with the test of battle. Machines, equipment, and men are not the only factors one must consider when desiring success. Tactics and doctrine, which will only evolve with the experience of battle, will help overcome shortfalls in machines, equipment, and men.

The answers to the questions of how the DH-4 fared in World War I lie in the words of the airman that flew the aircraft during campaign's such as the St. Mihiel and Muese-Argonne offensives. One of the main units to fly the DH-4 in combat was the 1st Day Bombardment Group (also affectionately known and the "Bewilderment Group" as it was badly led half of it's career). Having been formed on 9 September 1918, only two day's before the St. Mihiel offensive, it's mission was to conduct observation and bombing attacks during the forthcoming American offensive against key elements of the transportation system supplying the elements of the German armies which faced the

American Expeditionary Force (AEF). The group was composed of three squadrons, the 96th, 20th, and 11th. A fourth squadron was formed during the opening days of the Muese-Argonne offensive, the 166th. The 96th was equipped with the favored French Breguet 14B-2 aircraft, while the others were equipped with the Liberty planes. Of the groups four squadrons, the 96th was the most experienced having been operating on the Toul sector since mid-June.

Although there is still some difference of opinion on the performance of the American De Havilland, most combat flyers believed it was better suited for observation than for bombardment. Unencumbered by a load of bombs, the Liberty plane (powered by the heavy but powerful Liberty engine) was able to reach high altitudes and, essentially, outrun the German Fokker DVII's. American army observation came into its own during the St. Mihiel offensive. The primary American unit conducting observation missions was the 1st Day Bombardment Group with the Liberty planes. Each day, prior to the next day's attack, Liberty's in groups of three (with three other Liberty's used as top cover) would launch to photograph enemy centers of gravity such as lines of communication, headquarters facilities, and areas that contained enemy reserves. During the attack, Liberty observation planes maintained a continuous vigil over the battlefield, watching out for enemy troop movements, particularly reinforcements. The Liberty, which proved to be well suited for the observation mission, provided valuable intelligence to allied commanders during both the St. Mihiel and Meuse-Argonne offensives. The observation mission was not without danger, however, as at least one incident occurred when a DH-4 was blown up in flight by a passing artillery shell. Although the Liberty, due to its power, speed, and ceiling proved to be a very successful observation plane, it did have one major

shortfall when it came to this mission. This defect is summed up by Captain John Gilbert Winant, Commander of the 8th Aero Observation Squadron:

> The most serious defect of the DH-4 as an Observation aeroplane is the distance between the Pilot and the Observer. This difficulty has in part been done away with by the interphone. The supply of these phones has been limited—many planes have not got them. Successful cooperation between a Pilot and an Observer in a DH-4 without one is almost impossible.[1]

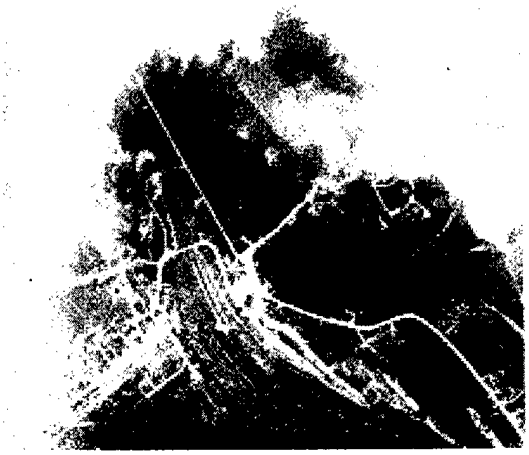

Figure 13. DH-4 Aerial Photo of German Railroad

As a bombardment platform, the DH-4 was hampered with many more problems, some of which were viewed as safety of flight and very unsettling to the crew. The defect that posed the greatest disadvantage, and which had a significant psychological effect on the flyers, was the location and vulnerability of the pressurized fuel tank. The tank, which was situated between the pilot and observers cockpit, was very vulnerable to machine gun fire and led to the DH-4's nickname of the "flaming coffin." The fully loaded Liberty plane was far more vulnerable to attack, especially by the new Fokker DVII's which were beginning to replace the older Albatros and Phalz types. The 1st Day Bombardment Group's main opposition was provided almost entirely by one crack German unit, the

Jagdgeschwader II, which was equipped with the Fokker DVII. Each of the four squadrons within this unit were commanded by Aces with victories raging from thirteen to thirty-four. Out of thirty-three DH's lost in combat by the AEF, only eight were shot down in flames. However, seven of these were from the 1st Day Bombardment Group. The problems with the pressurized fuel tank is summed up by Colonel Thomas DeWitt Milling, Chief of Air Service:

> In connection with the day bombardment, it might be mentioned that another reason which existed for their low morale (1st Day Bombardment Group) was due to the fact that the type of machine with which three of the squadrons were equipped, the DH-4, carries gas tanks which were unprotected by fire. It seems that it would of been a simple matter to have foreseen the necessity of supplying protected tanks. Successful experiments with suck tanks had been made in the United States before the undersigned left there, which was in August 1917. There are numerous cases where these machines were set on fire, not only when being attacked by enemy machines, but also when being struck by enemy anti-aircraft. French machines with protected tanks were returning to our lines intact with numberless holes in their gas tanks, one specific case of which I know having fourteen.[2]

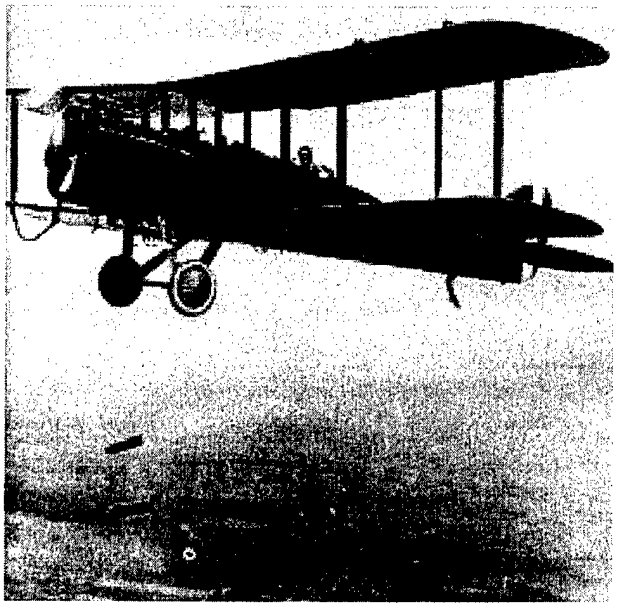

Figure 14. AEF DH-4 on Bombing Mission

Captain John Gilbert Winant, Commanding Officer of the 8th Aero Squadron, also shares his view on the problems associated with the DH-4's pressurized fuel tank:

> The only two planes of this Squadron shot thru the main tank, both fell in flames. A large tank under pressure is dangerous. Lieut_____of Colombey-les-Belles gave me a British Seldson to use for experimental purposes. This pump has been successfully installed in the main tank of one of our planes. It displaces the old pressure system by a suction system....If Seldson pumps could be provided for all DH-4 planes on the front, I believe the number of these planes brought down in flames would be cut in two.[3]

The 1st Day Bombardment Group, having to face Fokker DVII's with a pressurized fuel tank and a cumbersomely loaded DH-4, had difficulty keeping in the air and accomplishing the assigned mission. On the 18 of September, during the St. Mihiel offensive, an attack on Mars-La-Tour was undertaken by the 11th and 20th DH-4 squadrons. Seventeen aircraft took-off, one crashed on takeoff, and ten others did not reach the objective. Of the six that found and attacked the target, only one returned. All of the aircraft and crews lost were from the 11th squadron, which was forced to withdraw from operations and await reinforcements in aircrew and aircraft. After less than a week of operations, the American day bombardment capability was dangerously close to being non-existent. It was serious schooling.

The 1st Day Bombardment Group, having flown both the American DH-4 and the French Breguet 14B-2 aircraft, were continuously comparing the capabilities of each. A famous analysis of the two is annotated in the Gorrell History of the Air Service. The notes were included in the history of the 2nd Day Bombardment Group, which reflected the observations of veterans of the 1st day Bombardment Group that were transferred to the organization. The title of the analysis is "Why the De Havilland Liberty Four is a poor

Airplane for Day Bombardment" and "Why the French Breguet Bomber is a Successful Day Bombing Plane." The analysis is an in depth look at the differences in design, engine, and bombing capability. Some of the main reasons stated why the DH-4 was a poor bomber are: 1) It is not fast at great altitudes with a bomb load, 2) It doesn't carry enough bombs, 3) The pressurized fuel tank explodes when shot up, 4) The pilot and observer are too far apart, 5) The controls are exposed and easily shot away, 6) The engine bed is weak, 7) The Liberty motor is too heavy and powerful for the airframe, 8) There is no provision for a bombing site to be installed through the floor, 9) The bomb racks are not dependable, and 10) The position of the spark plugs on the Liberty motor make it necessary to wait for the engine to cool prior to changing the plugs, the plane may not be ready for the next raid. The reasons why the French bomber was successful is because the above mentioned did not apply, however, the analysis was perhaps a bit unfair, for the Breguet had some shortfalls as well.[4]

Because of the heavy casualties suffered during the St. Mihiel offensive, the 1st Day Bombardment Group, with some spurring from General Billy Mitchell, held a conference between the leaders of the squadrons to determine some better tactical doctrine. Realizing the shortfalls of the DH-4 aircraft and the vulnerability of small numbers, the leadership developed tactics designed around large formations of aircraft. These formations would include the DH-4 as well as the Breguet aircraft. These tactics were tested during the opening days of the Meuse-Argonne offensive, when on October 18th all four squadrons of the group mounted a raid against Bayonville. As it turned out, it was the single largest bombing raid ever mounted by the AEF and was most successful, as there was not a single loss in the group.

Even though effective tactical bombing would have to wait another 25 years, the United States Air Service bombing and observation forces in November 1918 were just beginning to acquire genuine proficiency when the war ended, and the DH-4 itself was finally beginning to have the bugs worked out.

Notes

[1]Mauer Mauer, *The U.S. Air Service In World War I*, Vol. IV, (Washington D.C.: Air Force Office of History, 1978), 120.

[2]Ibid., 12.

[3]Ibid., 120.

[4]Thomas G. Miller, *History of The First Day Bombardment Group*, (Massachusetts: World War I Aero Publishers, Inc., Vol. 1), 13.

Chapter 5

Conclusion

The United States Air Service had come a long way from its cautious beginnings when America entered World War I until the armistice was signed on 11 November 1918. Many lessons, most of them grim, had been learned by the pilots of the DH-4 squadrons. Of the nearly 300 American planes lost to enemy action, 164 fliers were killed in action, 102 were captured, 102 were wounded, and another 200 were labeled as "missing in action." The majority of these losses occurred during the last five months of the war when the bulk of American airpower was being delivered to the battle front.

The decision to put America's industrial strength behind the production of an American aircraft flown by American pilots powered by an American engine most undoubtedly presented some advantages and disadvantages. The most serious disadvantage, as advocated by General Billy Mitchell, was the time that was required to get the American Industrial machine cranked up to full speed. This, along with a three month ocean crossing and the time required to assemble and distribute the aircraft from Romorantin, delayed America's air effort in the war by more than a year. By the end of the war, once American production was near its maximum, US and allied aircraft numbers were too much for the Luftwaffe to handle. There were simply too many allied aircraft in German skies. This presents us with the argument of, "would the war have ended sooner

if the Aircraft Production Board had accepted General Mitchell's advisement to build proven French aircraft in France with raw materials and engineers from the US?" The answer to this question is subject to opinion, but it is safe to assume that the numbers and quality of battle proven aircraft would of been available much sooner to American aircrews. The primary advantage lended to the US and the allies by the introduction of the American built DH-4 had to do with pride and morale. Putting Americans to work building airplanes and engines strengthened the war effort in the US. One only has to examine the first American mission in American aircraft, when the results yielded nothing, but the effect on the morale of the flyers and the country were tremendous.

The performance of the American built De Havilland 4 aircraft in world War I is rests with the words of the airmen that flew it. Although not particularly popular with it's aircrew when comparing it's capabilities with other aircraft of the era (primarily the French Breguet 14B-2), the DH-4 "Liberty Plane" was finally coming to fruition when the war ended. The improvements to the DH-4, such as the addition of a bombing site, allowed certain airpower advocates of strategic bombardment, such as Mitchell, to advance the view that the true objective of the air war might be the enemy's national will and industrial capacity.[1] Although General Pershing, who had great respect for his senior air officer, had given his approval for raids against industrial targets (had the war continued into 1919), the DH-4's primary mission was to remain as an integral part of the AEF and to support the operations of the ground army. For this purpose, and the fact that the war had already become frozen in a complex pattern of trench warfare, the United States had little to do with the over-all development of air doctrine during the first world

war.[2] One can draw a very close comparison of the mission of the AEF with the mission of today's Marine Air to Ground Task Force (MAGTF).

Looking back, World War I was only a transitional phase in the development of the aircraft as a weapon. The war expanded the frontiers of air tactics from reconnaissance and observation to a more complex field of operations in support of land and sea forces.[3] The large bombers, such as the Gotha and Handley Page, and the medium bombers, such as the De Havilland DH-4 and the Breguet 14B2, opened up the future of aerial bombardment. The awesome potential of large scale bombing raids, which was recognized and advocated by the leaders in aviation, such as Trenchard and Mitchell, had become a reality. As summed up by General Mitchell:

> If we had sufficient bombardment aviation, we could have brought the war to a close by carrying it to the vital points in the interior of Germany and making the people sue for peace.[4]

As for the DH-4 "Liberty Plane," it served admirably during the interwar period. It was the backbone of American aviation up through 1929 as it was utilized extensively in both military and civilian aviation.

Notes

[1]James J. Hudson, *Hostile Skies*, (New York: Syracuse University Press, 1968), 302.
[2]Ibid., 301.
[3]Ibid., 304.
[4]Brigadier General William Mitchell, *Memoirs of World War* I, (New York: Random House, Copyright 1960), 196-197.

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